

### Microlevel Data Studies

Another set of recent studies of cigarette demand include those that used microlevel data—that is, data from groups of individuals instead of aggregate data sets. As with the studies that used aggregate data, these studies consistently indicated that cigarette smoking is affected negatively by price. Each of the studies carefully dealt with the smuggling problem that could bias the estimates of the price elasticities. Because they were based on microlevel data, the studies also avoided the simultaneity problems that arise when working with aggregate data. That is, no individual smoker consumes enough cigarettes to affect market price, so prices could be appropriately treated as exogenous in these studies.

Many of these studies, however, examined issues that cannot be addressed when using aggregate data. Studies that use microlevel data can assess the effect of prices and other policies, not only on average cigarette consumption (the focus of aggregate studies), but also on the probability that an individual smokes and on average consumption among smokers. Similarly, the effects of policy variables on smoking initiation and cessation can be explored. Microlevel data can be used to consider the differential effects of increased cigarette excise taxes and other policies on alternative demographic groups (by age or by gender, for example).

Lewit and Coate (1982) took advantage of cross-sectional survey data not only to estimate equations of the demand for cigarettes, but also to determine smoking prevalence and patterns of smoking participation. In addition, this study estimated separate demand equations for different age groups (20–25 years, 26–35 years, and 36–74 years) and for men and women. These investigators found that a price increase appeared to effect the decision to become a smoker rather than the decision to smoke less frequently. They also found that the smoking behavior of young adults (20 to 25 years old) was more sensitive to price changes than that of older individuals. Finally, they found that male smokers, particularly those aged 20 to 35 years, were quite responsive to price, whereas female smokers were essentially unaffected by price.

Mullahy (1985) introduced myopic addiction (i.e., the concept that addiction outweighs an individual's foresight or concern for future well-being) into his theoretical model of cigarette smoking. This model implies that at any given time, smoking initiation, regular use, and the amount of cigarettes smoked depend on an individual's smoking history. This model and other studies that formally model the addictive aspects of smoking incorporate the concepts of tolerance, reinforcement, and withdrawal that distinguish addictive consumption from nonaddictive consumption. Treating smokers as

myopic, however, implies that the future consequences of their smoking are ignored when they make current decisions. Mullahy estimated separate demand equations for men and women and found that both the decision to smoke and the quantity of cigarettes consumed by smokers were negatively related to cigarette prices for each gender. As in the Lewit and Coate study, Mullahy found that cigarette prices had a greater impact on the decision to smoke than they do on cigarette consumption. Similarly, he found that men were somewhat more responsive to price than women (average elasticities of -0.56 and -0.39, respectively).

Chaloupka (1990, 1991a, b) applied the Becker and Murphy (1988) model of rational addictive behavior to cigarette smoking. As in the Mullahy model, addiction is accounted for by recognizing that current smoking decisions depend on past smoking, whereas rationality implies that the future consequences of an individual's past and current smoking behavior are considered when making current choices. Chaloupka found both that cigarette smoking is addictive—that is, it depends on past smoking—and that individuals who smoke also consider future consequences. He found that increases in cigarette prices reduce average cigarette consumption significantly and that the effects of price increases on consumption are understated if the addictive aspects of consumption are ignored. In contrast with the findings of Lewit and Coate, Chaloupka found that adolescents and young adults (aged 17 through 24 years) were less responsive to price than are older age groups. Chaloupka also found, like Lewit and Coate, that women were much less responsive to price than men.

Wasserman et al. (1991) used several of the Health Interview Surveys conducted during the 1970s and 1980s to estimate the effects that taxes and regulations restricting smoking in public places have on adult cigarette demand. These investigators also examined whether the price elasticity of demand has changed over time. Using a generalized linear model, they found that the negative impact of cigarette prices on demand has increased over time. The estimated price elasticity of demand in 1970 (0.06) suggested that increases in cigarette excise taxes would not discourage cigarette smoking. However, the authors estimated an increasingly negative effect of cigarette prices on demand from 1974 (-0.17) through 1985 (-0.23). They estimated that by 1988, the price elasticity of demand would increase (in absolute value) to -0.28. This finding that the price elasticity of demand is becoming more negative over time contradicts the findings of the studies based on aggregate data by Baltagi and Goel. The estimated elasticities of Wasserman et al. were approximately half those estimated by Lewit and Coate, who used the same data. Wasserman et al. attributed these relatively low estimates to their including an index that

measured state-level antismoking regulations and was highly correlated with price. When this index was omitted, the effects of price on demand were overstated, since they included the true price effect as well as the effect of the omitted regulations. The findings of Wasserman et al. for youth will be discussed in detail in the next section.

The implications of these studies on older adolescents' and young adults' responsiveness to price are not conclusive. Lewit and Coate's examination of individuals 20 years old and older concluded that upward price elasticity is increasingly negative (and thereby has a stronger effect) for younger age groups. The addictive model that Chaloupka used, however, suggested that less addicted smokers (those who have a shorter history of smoking, for example) will be less responsive to price than their more addicted counterparts. His estimated long-run price elasticities of demand for older adolescents and young adults were consistent with this hypothesis. The following section addresses more specifically the effect of price on the smoking behavior of young people.

#### Price Responsiveness of Adolescent Smokers

A third set of recent econometric studies focused on youth. Each of these studies, as with the studies of adult smoking that employ microlevel data, carefully controlled for cigarette smuggling. Besides including cigarette prices and other determinants of demand employed in the studies of adult smoking, these youth studies included parental characteristics (such as education level and income) as proxies for parental smoking practices, which have been shown to be associated with youth smoking.

The first comprehensive studies of the price responsiveness of cigarette smoking among youth were completed in the early 1980s. Lewit, Coate, and Grossman (1981) used Cycle III of the Health Examination Survey (HES-III), which was conducted from March 1966 through March 1970, to look at the effects of cigarette prices, of the negative cigarette advertising broadcast under the Fairness Doctrine, and of various socioeconomic and demographic factors affecting cigarette smoking by youth (persons 12 through 17 years old). Besides examining average cigarette consumption among all youth, the authors also estimated equations for smoking participation for all youth as well as equations for cigarette demand for young smokers. This methodology, similar to that used by Lewit and Coate, allowed the authors to distinguish the effect of price on the decision to smoke from its effect on smokers' consumption of cigarettes. The authors found that most of the impact of prices on cigarette smoking was on the decision to smoke rather than on smokers' average

consumption of cigarettes: estimated price elasticity was -1.20 for smoking participation and -0.25 for cigarette demand. Furthermore, the estimated price elasticity of demand among youth in this study (-1.44) was more than three times as high as the estimate for adults in Lewit and Coate's study and nearly two times as high as that study's estimate for young adults (persons aged 20 through 25 years).

These findings were mostly confirmed in a related study by Grossman et al. (1983). This study used data from the 1974, 1976, 1977, and 1979 National Household Surveys on Drug Abuse. The surveys were analyzed separately because of differences in the definition of smoking. As the authors noted, the estimates from this study should be interpreted cautiously, since the sample sizes were much smaller than those of the study based on the HES-III. In general, Grossman et al. found that the decision to smoke was negatively related to the price of cigarettes; their summary estimate of this elasticity was -0.76. Again, this estimate was substantially higher, in absolute value, than that obtained for adults by Lewit and Coate, and it implies that young people's decision to smoke is much more responsive to price than the comparable decision for adults. However, Grossman et al. found that once the decision to smoke has been made, average consumption decisions by young smokers were virtually unresponsive to price.

Warner (1985, 1986) used the age-specific price elasticities of participation and demand from Lewit and Coate to obtain comparable estimates of price elasticity for teenagers (persons aged 12 through 17 and 18 through 19). He used these age-specific data to estimate that the doubling of the federal excise tax in 1983 reduced the number of teenage smokers by 800,000, assuming that average cigarette prices increased by the 8 cents that the tax increased. These estimates form the basis for a U.S. General Accounting Office (GAO) report, which concluded that raising the federal tax further by 20 cents per pack would have reduced the number of teenage smokers by an additional 500,000 in 1989 (GAO 1989). The GAO predicted a subsequent reduction of 125,000 smoking-related deaths for this age group as a result of the proposed 20-cent tax increase.

Similarly, Harris (1987) used the Lewit, Coate, and Grossman estimates, among others, to examine the effects that the 1983 doubling of the federal excise tax on cigarettes had on cigarette smoking and health. He concluded that the tax increase and the coordinated price increases it induced kept 600,000 teenagers (persons aged 12 through 17 years) from starting to smoke. Basing his findings on epidemiologic studies of the 1950s, 1960s, and 1970s, Harris concluded that 54,000 more teenagers would live to age 65 as a result of this tax.

The recent study by Wasserman et al. (1991) contradicted the general conclusion of Lewit and Coate that teenage cigarette smoking is more responsive than adult smoking to changes in cigarette prices. Wasserman et al. used the Second National Health and Nutrition Examination Survey (1976–1980) (NHANES-II) to estimate the effects of cigarette prices and antismoking regulations on cigarette smoking by youth aged 12 through 17. In both the generalized linear models and the two-part models they estimated, the authors found a statistically insignificant effect of cigarette prices on average cigarette consumption among all youth, on smoking participation rates among all youth, and on cigarette consumption by young smokers. Given the range of estimates obtained, the investigators could not reject the hypothesis that the price elasticity of demand for teenagers was statistically different from their estimate of -0.23 for adults. Their estimates for youth were consistent with Chaloupka's (1991b) young adult estimates, which also employed NHANES-II data. As was discussed earlier, Wasserman et al. suggested that one of the reasons for their relatively low estimated price elasticity of demand was their including an index that captured antismoking regulations as a determinant of demand. Thus, they concluded that the price effects estimated in other studies may have been biased upwards, since prices alone were being credited with the effects of various contemporaneous antismoking regulations that likely played an important role in discouraging young people from smoking.

Grossman (1991) noted, however, that the study by Wasserman et al., while a valuable contribution to the empirical literature on cigarette demand, should not be considered as offering the definitive estimates of the price elasticity of demand, particularly for youth. Others, including Chaloupka (1988) and Chaloupka and Saffer (1992), did not find that the estimated price elasticity of demand was sensitive to the inclusion of measures of antismoking regulations, although these other studies used smaller sample sizes than did Wasserman et al. Furthermore, including the regulation index may be less relevant in a teenage sample, since the index assumes its highest value in states that restrict smoking in private worksites. If the regulations themselves have no direct impact on smoking, but are instead proxies for antismoking sentiment, then enacting very restrictive measures may not necessarily reduce youth smoking. For example, during the 1980s, restrictions on public smoking were enacted across the United States, yet smoking onset rates among young people did not decline significantly (see "Trends in Cigarette Smoking" in Chapter 3). Finally, the Wasserman et al. (1991) findings for a relatively small sample of youth ( $N = 1,891$ ) should be interpreted cautiously when compared with those obtained by Lewit, Coate, and Grossman (1981) ( $N = 5,308$ ).

## Discussion

The large amount of empirical literature on the relationship between cigarette prices and cigarette smoking suggests that increased excise taxes on cigarettes would significantly reduce overall rates of cigarette smoking. Much of the impact of higher prices would come from encouraging cessation among current smokers and discouraging initiation among young smokers. The price responsiveness of adolescents is at least as high, if not significantly higher, than that of adults—a finding that suggests that an increase in cigarette taxes would result in large reductions in smoking prevalence and cigarette consumption among teenagers.

Although numerous studies of aggregate cigarette demand and several studies of cigarette smoking among youth have been completed in recent years, the relationship between other tobacco taxes and the use of tobacco products other than cigarettes has not been examined.

## Tax Policies Under Consideration

Increased taxes on cigarette and other tobacco products have been widely used in recent years as a source of federal, state, and local revenue. These taxes also are seen as a way to improve public health by discouraging cigarette smoking. Two proposals discussed in the 1989 Surgeon General's report on smoking and health (USDHHS 1989) have received the most attention. The first proposal is to increase tobacco taxes in general and to change the way in which these taxes are calculated. The second proposal would earmark the revenue generated by tobacco taxes to pay for tobacco-control programs or the health care costs related to smoking. Most of the proposals discussed below concern cigarette taxes; similar policies could be adopted for taxes on other tobacco products as well.

### Increasing Tobacco Taxes

An increase in the federal excise tax on cigarettes is the most widely supported tax policy proposal. Proponents—which include a number of public health groups, such as the American Lung Association, the AMA, the ACS, the American Heart Association, and the American Public Health Association—argue that the cigarette tax should be increased, because even after recent increases, the real value of the tax is still well below what it was in 1951. Also suggested is the repeal of the federally approved exemption for state taxes of cigarette sales on military bases and Native American reservations.

Similarly, despite recent increases in state excise taxes on cigarettes, the average state's real excise tax on cigarettes is at about the same level as it was shortly after the release of the first Surgeon General's report on smoking and health. In several states (notably the large

tobacco-producing states), the effects of inflation have been allowed to substantially reduce the values of these taxes. Although additional tax increases in states that have continually raised their cigarette excise taxes over time could spur a return to the organized smuggling of the 1970s, this problem possibly could be solved by levying larger tax increases in the states that have relatively low cigarette taxes and by instituting a tax in the four states that currently exclude cigarettes from the in-state sales tax.

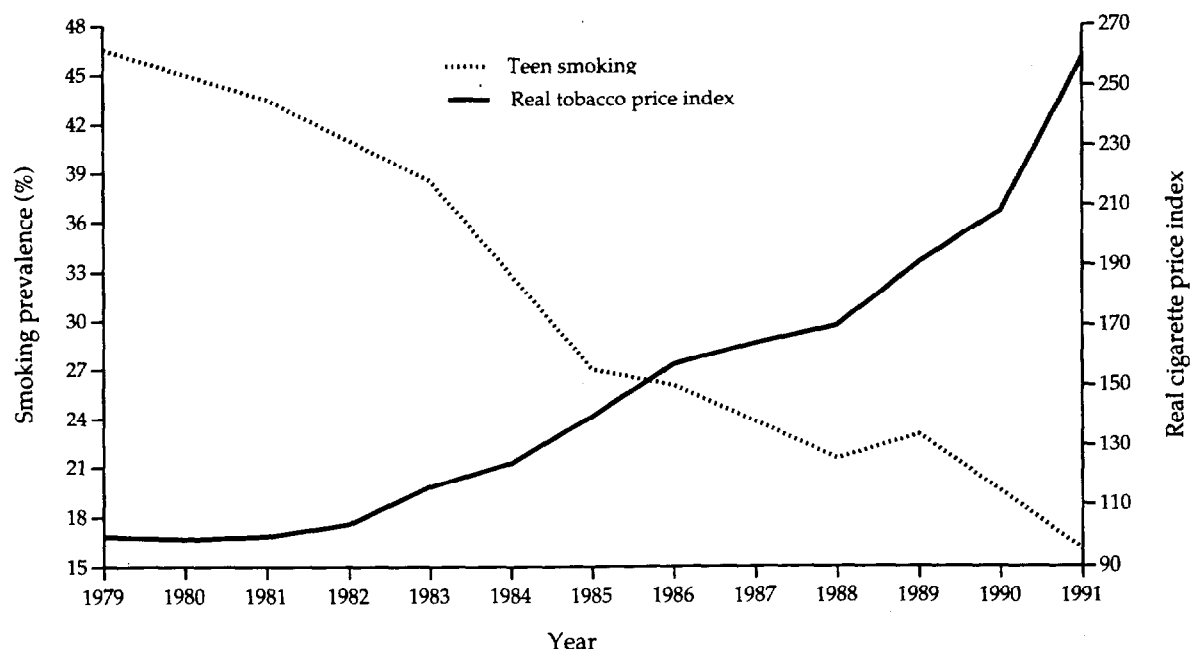
These tax increases would raise cigarette prices in the short run; without continued increases, however, the real value of the tax would be reduced by inflation over time. Given the importance of taxes in cigarette prices, the real cigarette price could even decline, as it did from 1971 to 1981. An alternative might be to replace the excise tax with an ad valorem tax, which would increase proportionately as the nontaxed price of cigarettes increases. The federal government imposes an ad valorem tax on large cigars only, and most states levy ad valorem taxes on tobacco products other than cigarettes.

An ad valorem tax, however, may have an unintended consequence of lulling the public's awareness of a tax increase, since ad valorem taxes may be perceived—and accepted—as part of overall inflation. Periodic increases in excise taxes, on the other hand, may

be publicized each time they occur and thus may stimulate public discussion of the health effects of smoking. Canada's experience with ad valorem taxes suggests that any mechanism that raises cigarette prices will be effective in reducing cigarette smoking.

To offset declines in real revenues due to inflation, Canada switched to an ad valorem tax on cigarettes at both the federal and provincial levels in the 1980s. These ad valorem taxes were partly responsible for a 25 percent increase in real cigarette prices, which was accompanied by a 10 percent decline in adult consumption of cigarettes (Sweanor 1991). In 1984, however, the ad valorem tax system was dropped after heavy lobbying by the tobacco industry and a lack of support from public health groups. Since then, there have been large increases in both federal and provincial excise taxes. By June 1, 1991, the average total tax on a pack of 20 cigarettes in Canada was \$3.72, more than eight times what it was in 1980 and approximately seven times the average in the United States. The large increases in Canadian taxes since 1985 are estimated to have reduced adult consumption by 35 percent and teenage consumption by 62 percent. These data included tobacco imported from the United States (Sweanor 1991; see Figure 6). Canada's experience in the 1980s provides a nationwide example of the effect of a tax increase on cigarette smoking among young people.

**Figure 6. Real\* cigarette prices and cigarette smoking prevalence among Canadians aged 15–19 years, 1979–1991**



Sources: Health and Welfare Canada (1991); Sweanor (1992).

\*The price of cigarettes relative to the price of all goods and services in Canada, adjusted for inflation with 1979–1980 being the benchmark years.

Related proposals include indexing the federal cigarette excise tax to the rate of inflation or to some measure of cigarette prices. Each of these proposals would have the benefit of offsetting the effects of inflation on the value of the taxes and tax revenue over time, and each would be only slightly more cumbersome to administer than current tax structures.

Opponents of these tax changes argue that increases would place an unfair burden on the poor. In general, excise taxes and other consumption taxes are regressive, in that they require lower-income individuals to pay a greater share of their incomes in taxes. The CBO estimates that increased cigarette excise taxes would most affect individuals in the lowest income categories (CBO 1990). However, as the CBO also explains, alternative tax and transfer policies could offset the regressiveness of a tax increase. Proponents of these tax changes point out that lung cancer and other smoking-related diseases also disproportionately affect the poor; moreover, if the tax revenues are earmarked to programs directed to the poor, then the overall policy is not regressive.

Another side effect of an increase in the federal tax on cigarettes would be the reduction of state and local cigarette tax collections as cigarette consumption falls. On the other hand, if state taxes on cigarettes increase with federal taxes, state revenues could increase as well, as occurred in 1983. Lastly, opponents of tax changes argue that increases in taxes would also increase incentives to evade taxes. The CBO estimates, however, that any resulting increases in tax evasion would be relatively minor.

#### Earmarking Taxes

The apparent success of Proposition 99 in California has increased interest in adopting similar policies

elsewhere. Of the revenues generated from the tax increase of 25 cents per pack, 20 percent are dedicated to antismoking education, 5 percent to research, 5 percent to environmental and other specified programs, and 70 percent to medical care for the poor. Recent attempts by the governor to redirect some of these revenues to other purposes were stopped by the state courts. Similar earmarking of part of the state excise on cigarettes takes place in Nebraska (for its cancer and smoking research program), Minnesota (for the state public health fund), Utah (for its tobacco-control programs), and Indiana (for subsidizing of child care). Earmarking the revenues from tobacco taxes to tobacco-control programs reinforces the impact that increased tobacco taxes have on tobacco consumption. Early evidence from California (Flewelling et al. 1992; Keeler et al. 1992) indicates that the combined impact of the increased excise tax on cigarettes and the increased tobacco-control activities funded by these tax increases has resulted in reduced cigarette consumption.

On its November 1992 ballot, Massachusetts passed a measure similar to Proposition 99. This measure institutes a state excise tax increase of 25 cents per cigarette pack and a 25 percent increase in the tax on chewing tobacco. Some of the revenue from the increases may be dedicated to tobacco-control programs. Public health professionals in Colorado, Nebraska, Arkansas, Michigan, and Oregon are advocating similar measures. These types of large increases in cigarette excise taxes, where at least part of the increased revenues is earmarked for other antismoking activities, have the added advantage of stimulating the discussion of the health consequences of smoking. As a result, reductions in smoking may be larger than anticipated.

## Conclusions

This chapter reviewed a large body of literature concerning programs and policies to prevent tobacco use among young people. These measures, from education to taxation, are strongly supported by the United States public. Given the number of young people who continue to initiate use during adolescence, and given the strong role of the social environment in the process of initiation, efforts to prevent the onset of tobacco use may need multiple, complementary components, including those described in this chapter, and may need to be implemented at the national, state, and community levels to have long-term impact.

1. Most of the American public strongly favor policies that might prevent tobacco use among young people. These policies include tobacco education in the schools, restrictions on tobacco advertising and promotions, a complete ban on smoking by anyone on school grounds, prohibition of the sale of tobacco products to minors, and earmarked tax increases on tobacco products.
2. School-based smoking-prevention programs that identify social influences to smoke and teach skills to resist those influences have demonstrated consistent and significant reductions in adolescent smoking

prevalence, and program effects have lasted one to three years. Programs to prevent smokeless tobacco use that are based on the same model have also demonstrated modest reductions in the initiation of smokeless tobacco use.

3. The effectiveness of school-based smoking-prevention programs appears to be enhanced and sustained by comprehensive school health education and by communitywide programs that involve parents, mass media, community organizations, or other elements of an adolescent's social environment.
4. Smoking-cessation programs tend to have low success rates. Recruiting and retaining adolescents in formal cessation programs are difficult.
5. Illegal sales of tobacco products are common. Active enforcement of age-at-sale policies by public officials and community members appears necessary to prevent minors' access to tobacco.
6. Econometric and other studies indicate that increases in the real price of cigarettes significantly reduce cigarette smoking; young people are at least as responsive as adults to such price changes. Maintaining higher real prices of cigarettes depends on further tax increases to offset the effects of inflation.

## References

### Chapter 2: The Health Consequences of Tobacco Use by Young People

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### Chapter 4: Psychosocial Risk Factors for Initiating Tobacco Use

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